

CLAIMS

1. A method for determining thickness of a layer in a structure comprising at least one layer, the method comprising the steps of:

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- providing a response signal representing a signal reflected by the structure,
- selecting, from the response signal, a first reflection between a first layer and a previous layer,
- predicting a shape of a further reflection from an interface between the first layer and a subsequent layer,
- 10 - locating, in the response signal, the further reflection using the predicted shape of said second reflection,
- determining a duration between the first reflection and the further reflection and, from the determined duration, determining the thickness of the first layer,

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wherein the prediction is based upon the first reflection.

2. A method according to claim 1, further comprising the step of:

- transmitting a signal from a point of transmission towards the structure and receiving a
20 reflected signal at a point of reception, so as to provide the response signal.

3. A method according to claim 1, wherein the structure is a multi-layer structure comprising at least two layers.

25 4. A method according to claim 1, further comprising the steps of:

- from at least one of the first reflection or a second reflection, predicting a shape of a third reflection from an interface between a second layer and a subsequent layer,
- locating, in the response signal, the third reflection using the predicted shape of said third reflection,
- 30 - determining a duration between a previous reflection and the third reflection and, from the determined duration, determining the thickness of the second layer.

5. A method according to claim 1, further comprising the steps of:

- from at least one of the first, second or third reflection, predicting a shape of a fourth
35 reflection from an interface between a third layer and a subsequent layer,
- locating, in the response signal, the fourth reflection using the predicted shape of said fourth reflection,
- determining a duration between a previous reflection and the fourth reflection and, from the determined duration, determining the thickness of the third layer.

6. A method according to claim 1, wherein the step of predicting the shape of the further reflection comprises:
- transforming the selected first reflection to a frequency domain,
 - 5 - applying an attenuation function to said transformed selected first reflection, so as to obtain a representation of the shape in the frequency domain,
 - transforming said representation to a time domain, so as to obtain the prediction of the shape.
- 10 7. A method according to claim 6, wherein thickness and attenuation properties of the layers of the substrate are used to determine the applied attenuation function.
8. A method according to claim 1, wherein the step of locating comprises:
- in the time domain, shifting the predicted shape between positions in an examination
 - 15 zone comprising at least a part of the response signal,
 - for each position, determining a degree of coincidence between the predicted shape and the response signal,
 - selecting the position having the best coincidence.
- 20 9. A method according to claim 8, wherein determination of the degree of coincidence is based on a calculated difference between the predicted shape and the response signal.
10. A method according to claim 9, wherein the calculated difference is determined on an L1 norm criterion.
- 25 11. A method according to claim 9, wherein the calculated difference is determined on a least square criterion.
12. A method according to claim 8, wherein information about the signal transmitted
- 30 through the materials and attenuation properties of said materials are used to predict the examination zone.
13. A method according to claim 2, wherein a liquid is provided between the point of transmission and the structure.
- 35 14. A method according to claim 13, wherein the liquid comprises water.
15. A method according to claim 1, wherein the structure comprises a pipe.

16. A method according to claim 15, wherein the pipe comprises a plurality of layers.
17. A method according to claim 2, wherein duration of the signal transmitted is less than the time required for said signal to cover a first distance, said first distance extending from
5 the point of transmission to an interface between two materials, at least one said two materials being comprised in the structure.
18. A method according to claim 17, wherein the first distance extends between the point of transmission and the first layer.
- 10 19. A method according to claim 2, wherein the signal transmitted from the point of transmission is an ultrasonic signal.
20. A method according to claim 1, wherein an outer layer of the structure comprises the
15 first layer.
21. An apparatus for determining thickness of a layer in a structure comprising at least one layer, the apparatus comprising:
- 20 - means for transmitting a signal and means for detecting a response signal,
- processing means adapted to process the response signal in accordance with the method of claim 1.
22. An apparatus according to claim 21, wherein the processing means comprises a
25 computer programme adapted to perform the method according to claim 1.
23. A computer system comprising data processing means which co-operates with computer program means to perform the method of claim 1.
- 30 24. A computer programme for a computer system according to claim 23.
25. The use of the method according to claim 1, wherein the method is used to determine thickness of layers in a pipe during production of said pipe.